

# Assessment of Physico-Chemical Properties and Micronutrient Status of Inceptisol Soils from Manjra Basin Area of Latur Tahsil of Latur District

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## Abstract

The present investigation carried out entitled "Assessment of secondary and micronutrient status of soils of Manjra basin area of Latur tahsil in Latur district." was undertaken for assessing the fertility status of soils from Latur tahsil. For this purpose total 100 soil samples were collected from twenty villages, among each village five soil samples were collected from Manjra basin area of Latur tahsil. These soil samples were distributed according to their representative depth as per order. Out of which which 61 samples, 27 samples, 12 samples were categorized as Inceptisols, Entisols and Vertisols respectively. Further, this collected soil samples were analyzed for their physico-chemical properties (pH, Electrical conductivity, organic carbon and calcium carbonate) DTPA micronutrients iron, manganese, zinc, copper and available boron). The soils of Manjra basin area of Latur tahsil under Inceptisols were neutral to moderately alkaline in soil pH, safe in electrical conductivity for crop growth, low to moderately high in organic carbon content and non-calcareous to calcareous in nature. The DTPA extractable Zn was low to medium, Fe, Mn and Cu were high and available B was low to medium in soils of Latur tahsil. Zn was positive significant correlation with EC. positive significant correlation with OC and CaCO<sub>3</sub> in soils of Inceptisol of Manjra basin area of Latur Tahsil.

**Key words :** Inceptisols, ctrical conductivity, organic carbon and calcium carbonate.

Soil fertility is the major component of productivity which primarily deals with nutrient supplying capacity of the soil to the plant. Thus, it has been always considered to carry out genetic study as well as to find out fertility evaluation for making best use of the soil for crop production (Anonymous 2011). Latur District comprises 7273 sq.km area. Major growing crops in this region are soybean, groundnut, sugarcane, sunflower and some horticultural crops. The land comprises various types of soils with lot of variation in fertility status. The physico-chemical properties viz, soil pH, EC, calcium carbonate and organic carbon were important in deciding availability of essential nutrient in soil and thereby for crop production. EC affects yields, crop suitability, plant nutrient availability. Calcium carbonate affect the availability of micronutrients. Soil

organic carbon (SOC) is the most important component in maintaining soil quality because of its role in improving physical, chemical, and biological properties of the soil. The micronutrients like zinc, iron, manganese and copper and boron are important micronutrients. Zinc is an important micronutrient of soil which is required for catalysis of different enzymes like carbonic unhydrase and aldolases, Copper is an activator of different enzymes like tyrosinase, ascorbic acid oxidase, lactase etc., Manganese is essential micronutrients in soil which plays crucial role in photosynthesis and catalysis process of enzymes. Where as iron exist in the form of ferrous and ferric ions in soils which are beneficial for healthy plant growth. Boron It is used with Ca in cell wall synthesis and is essential for cell division. Soil test-based fertility management might be one of an approach for sustainable agricultural production system.

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## Materials and Methods

The Latur district is located between N 17° 55' N 18° 50' North and E 76°15' E 77°15' East in deccan plateau respectively. The soils of Latur district comes under the category Vertisol, Inceptisol, and Entisol. Major soils of Latur district are derived from "Deccan trap" rocks. These soils were deep to shallow black and light textured. The soils of Latur districts are varied in colours due to occurrence of minerals like smectite, kaolinite, and vermiculite. On the basis of soil depth and texture, these soils have been classified into deep to medium black and shallow black soils (Gajbe *et al.* 1976). All the collected soil samples were brought to the laboratory and dried. After drying, a part of each sample meant for analysis were ground with wooden mortar and pestle, passed through 0.5 mm sieve and used for further analysis. The soil pH and EC was estimated by 1:2.5 soil water suspension as per the method described by Jackson (1973), and categorized by rating given by Muhr (1965). Modified Walkley and Black's (1934) rapid titration procedure was followed for estimating the organic carbon content. Ratings was given by Rammoorthy and Bajaj (1969) CaCO<sub>3</sub> was estimated by rapid titration method as described by Piper (1966). DTPA Micronutrients Iron (Fe), Manganese (Mn), Zinc (Zn) and Copper (Cu) It was estimated by method described by Lindsay and Norvell (1978). Available Boron It was determined by Hot water soluble method given by Berger and Troug (1939) and Ratings of micronutrients given by More *et al.*, (2005).

## Results and discussion

**Physico-Chemical properties of soils from Manjra basin area of Latur tahsil under Inceptisol :** The data on pH, electrical conductivity, organic carbon and calcium carbonate of Manjra basin area of Latur tahsil under Inceptisol were presented in Table 1 and

categorization of each parameter in Table 2. The data shows that, the pH of these soil was ranged from 6.31 to 7.86 with an average value of 7.52. with SE value 0.03 and CV value 36 percent. Out of 61 soil samples in inceptisol soil 39 soil samples (63.93 %) were moderately alkaline (7.5- 8.5) in reaction, 21 (34.42%) were neutral (6.5-7.5) and only 1 (1.63%) was slightly acidic (6.0-6.5.) in nature. Most of soil samples were observed neutral to moderately alkaline in reaction. The value indicates that the soils of Inceptisol of Manjra basin area were neutral to moderately alkaline in reaction this might be due to presence of high degree of base saturation. Nirawar *et al.* (2009) reported that, pH of Ahmedpur tahsil, were ranges from 6.56 to 8.6. The electrical conductivity of soil was varied from 0.25 to 1.19 dS m<sup>-1</sup> with a mean value of 0.59 dS m<sup>-1</sup>. out of 61 soil samples from Inceptisol 59 (96.73%) were safe and have no deleterious effect on crops (<1.0 dS m<sup>-1</sup>). Whereas, only 2 (3.27%) soil samples were observed in range of critical for germination (1-2 dS m<sup>-1</sup>) The low EC content of these soil was due to high precipitation and leaching of salts to lower horizon. Shinde (2007) reported that, EC of soils from Udgir and Deoni tahsil were varied from 0.10 to 2.17 and 0.13 to 1.17 dS m<sup>-1</sup>. The organic carbon content of Inceptisol soils of Manjra basin area of Latur tahsil were ranged from 1.4 to 8.1 g kg<sup>-1</sup> with an average value of 4.2 g kg<sup>-1</sup>. Among the 61 soil samples, 09 (14.75%) were very low, 21 (34.42%) were low, 19 (31.14%) were medium, 11(18.03) were

**Table 1.** Status of Physico-Chemical properties of soils from Inceptisol of Latur tahsil

Particular	pH	EC (dS m <sup>-1</sup> )	OC (g kg <sup>-1</sup> )	CaCO <sub>3</sub> (g kg <sup>-1</sup> )
Range	6.31-7.86	0.25-1.19	1.4-8.1	5-68.5
Mean	7.528	0.591	4.2	26.66
SE	0.035	0.023	0.2	1.40
CV (%)	0.036	0.304	0.4	0.40

**Table 2.** Categorization of soils from Inceptisol on the basis of Physicochemical properties

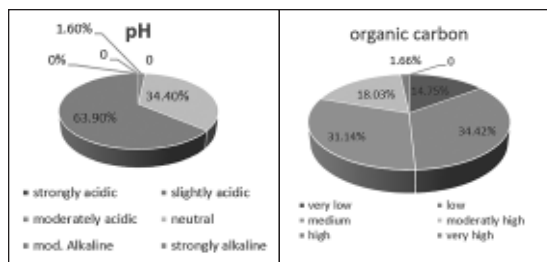
Parameters	Range					
<b>pH</b>	<b>Strongly acid (&lt; 5.5)</b>	<b>Moderate acid (5.5-6.0)</b>	<b>Slightly acid (6.0-6.5)</b>	<b>Neutral (6.5-7.5)</b>	<b>Mod. alkaline (7.5-8.5)</b>	<b>Strongly alkaline (&gt; 8.5)</b>
%	-	-	1.6	34.4	63.9	-
No. of Sample	-	-	1	21	39	-
<b>EC (dSm<sup>-1</sup>)</b>	<b>No deleterious effect on crop (&lt; 1)</b>	<b>Critical for germination (1-2)</b>	<b>Critical for crop growth (2-3)</b>	<b>Injuries to most of the crop (&gt; 3)</b>		
%	96.73	3.27	-	-		
No. of Sample	59	2	-	-		
<b>OC (g kg<sup>-1</sup>)</b>	<b>Very low (&lt; 2)</b>	<b>Low (2.1- 4)</b>	<b>Medium (4.1- 6)</b>	<b>Mod. high (6.1-8)</b>	<b>High (8.1-10)</b>	<b>Very high (&gt; 10)</b>
%	14.75	34.42	31.14	18.03	1.63	-
No. of Sample	9	21	19	11	1	-
<b>CaCO<sub>3</sub> (g kg<sup>-1</sup>)</b>	<b>Non-calcareous (&lt; 50)</b>	<b>Calcareous (50-150)</b>	<b>Highly calcareous (&gt; 150)</b>			
%	98.36	1.63	-			
No. of sample	60	1	-			

moderately high and only 1(1.63%) was high in organic carbon content. organic carbon content of Inceptisol were low to medium in range was due to factors like temperature, which is responsible for accelerate the rate of oxidation as well as very little addition of organic matter and crop residues in to soil. Hadole *et al.* (2020) observed that organic carbon content in soils of Solapur districts were ranged from 2.67 to 13.37 g kg<sup>-1</sup> in soils of Solapur district. The calcium carbonate content from Inceptisol soil were varied from 5 to 68.5 g kg<sup>-1</sup> with an average value of 26.8 g kg<sup>-1</sup>. Among the 61 samples, 60 were non-calcareous and only 1 was calcareous in nature. the CaCO<sub>3</sub> content in soils of Inceptisol were low to medium this might be due to presence of CaCO<sub>3</sub> in powdery form

and hyper thermic temperature of Latur tahsil. Patil *et al.* (2019) reported that calcium carbonate in Inceptisol of washi tahsil were ranged from 4.0 to 168 g kg<sup>-1</sup>. These results were in confirmatory with results reported by Hadole *et al.* (2020).

**Table 3.** Status of micronutrients from Manjra basin area of Latur tahsil under Inceptisol

Parameter /Range	Zn (mg kg <sup>-1</sup> )	Fe (mg kg <sup>-1</sup> )	Mn (mg kg <sup>-1</sup> )	Cu (mg kg <sup>-1</sup> )	B (mg kg <sup>-1</sup> )
Minimum	0.42	2.40	2.18	2.11	0.01
Maximum	1.73	19.98	11.34	10.89	1.2
Mean	0.744	7.876	6.330	7.065	0.297
SE	0.03	0.985	0.834	0.829	0.488
C.V. (%)	30.8	35.09	33.16	31.19	89.49



**Fig. 1.** Status of pH and organic carbon of soils from Manjra basin area of Latur tahsil in Inceptisol

### Status of DTPA Zn, Fe, Mn, Cu and available B in Inceptisol soils of Manjra basin area of Latur tahsil

The data regarding DTPA Zn, Fe, Mn, Cu and available B are presented in Table 3.

**DTPA Zn :** The Zn content in Inceptisol soil in Manjra basin area of Latur were varied from 0.42 to 1.73 mg kg<sup>-1</sup> with average value 0.729 mg kg<sup>-1</sup> with SE value 0.02 and CV value 30.8 percent. The values describes that the available Zn content in soils of Manjra basin area was low to medium in range. This might be due to in alkaline condition, Zinc cations are heavily charged to their oxides or hydroxides, which reduces the availability of zinc. The similar results were obtained by Waghmare *et al.* (2008).

**DTPA Fe :** DTPA Fe content in soils of Inceptisol of Manjra basin area were varied from 2.40 to 19.98 mg kg<sup>-1</sup> with mean value of 7.45 mg kg<sup>-1</sup>. With SE and CV value was 0.05 and 42.47 percent respectively. Among 61 soil samples the 77 percent soil samples were high

in DTPA iron content. 20 percent soil samples were medium in DTPA iron content and only 3 percent soil samples were low in DTPA iron content. The data shows that soils were medium to high in iron content. This could be attributed due to presence of minerals like feldspar, limonite, magnetite and Haematite in soils. Waghmare *et al.* (2008) reported that, soils of Ausa tahsil for available Fe content were varied from 2.67 to 21.71 mg kg<sup>-1</sup>.

**DTPA Mn :** The DTPA Mn content of Inceptisol of Latur tahsil were ranged from 2.18 to 11.34 mg kg<sup>-1</sup> with mean value of 6.33 mg kg<sup>-1</sup> with SE value 0.83 and CV value 33.16 percent. from 61 soil samples all were high in DTPA Mn content. The high content of DTPA Mn might be due to soils derived from basaltic rock which contain higher ferromagnesium minerals. Similar findings were reported by Waghmare *et al.* (2008).

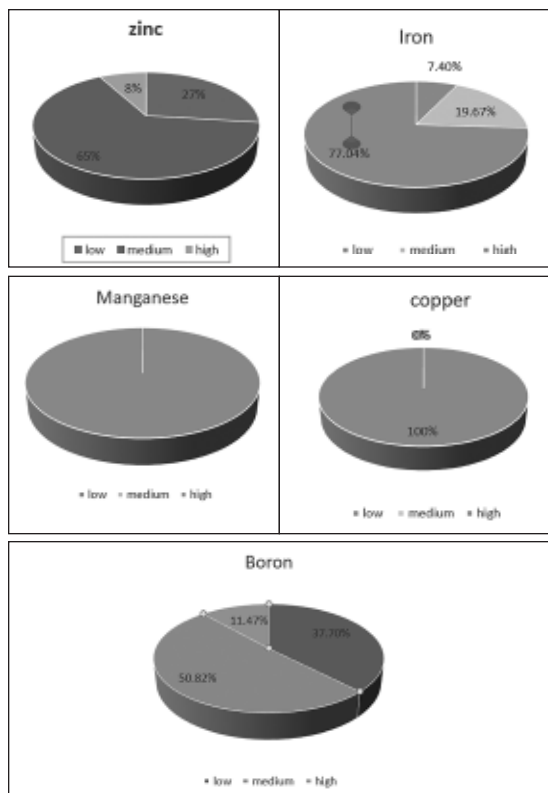
**DTPA Cu :** The DTPA Cu content of Inceptisol of Latur tahsil were varied from 2.11 to 10.89 mg kg<sup>-1</sup> with a mean value of 7.06 mg kg<sup>-1</sup> with SE value 0.036 and CV value 31.19 percent. All the samples of Inceptisol were high in copper content. This high content of copper might be due to presence of Cu minerals like Cuprite and chalcocite in parent material. These results were in confirmatory with results reported by Waghmare *et al.* (2008).

**Available Boron :** Available boron in soils of Manjra basin area were varied from 0.01 to 1.2 mg kg<sup>-1</sup> with average value of 0.29 mg kg<sup>-1</sup> with SE value 0.0043 and CV value 89.49 percent. The soils were high in available boron

**Table 4.** Categorization of micronutrients as per ratings

	Zn (mg kg <sup>-1</sup> )			Fe (mg kg <sup>-1</sup> )			Mn (mg kg <sup>-1</sup> )			Cu (mg kg <sup>-1</sup> )			B (mg kg <sup>-1</sup> )		
	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H
N.of samp	17	40	4	2	12	47	-	-	61	-	-	61	23	31	7
Percentage	27	65	8	7.4	19.67	77.04	-	-	100	-	-	100	37.70	50.81	11.47

The values in given Parenthesis indicates. L-low, M-medium, H-high



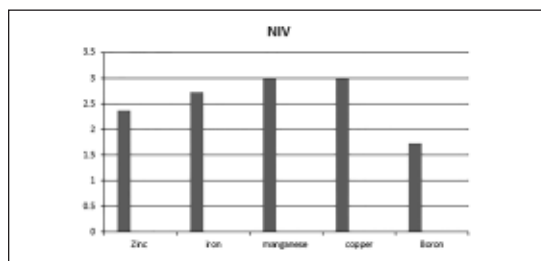
**Fig. 2.** Status of available micronutrient of Manjra basin area of Latur tahsil under Inceptisol

content This might be due to accumulation of B in highly soluble form of calcium and sodium and boron occurs mostly in the surface soil. Similar results were reported by Jagtap *et al.* (2018).

**Soil Nutrient index :** Table 5 indicates the nutrient index values of micronutrients such as DTPA Zn, Fe, Mn, Cu and available B from Manjra basin area of Latur tahsil. According to soil nutrient index, most of the soils of Latur tahsil were high in DTPA micronutrients and available B. The maximum fertility status for iron, manganese and copper while medium with respect to zinc and boron. The values revealed from nutrient index for Fe, Mn, Cu, Zn and B were 2.73, 3.00, 3.00, 2.37 and 1.73 (Fig. 2)

**Table 5.** Nutrient index values for Micronutrients

Nutrient	NIV	Category
Zn	2.37	Medium
Fe	2.73	High
Mn	3.00	High
Cu	3.00	High
B	1.73	Medium



**Fig. 3.** nutrient index values of available micronutrients in Manjra basin area of Latur Tahsil

### Conclusion

The soils from Manjra basin area of Latur tahsil were neutral to moderately alkaline in nature, safe in Electrical conductivity, noncalcareous to Calcareous in nature and low to medium. According to concept of soil nutrient index the status of DTPA Zn and available B were medium to low in content, DTPA Fe, Mn, Cu were high in content in most of the soils of Latur tahsil. DTPA Zn showed positive correlation with EC and OC, DTPA Fe were positively and significantly correlated with organic carbon. DTPA Mn had positive correlation with organic carbon. Further, the available Boron was positive significant correlation with organic carbon

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